



Structural Technical Memorandum

Date: January 10th, 2004
To: Nicole McIntosh, WSF
From: Barbara Moffat, Jacobs Civil Inc.
Project: Structural System Investigation for Tahlequah Design Options

Improvements for the Tahlequah Ferry Terminal are presented in four Design Options. Each option includes either expansion or relocation of the existing parking area. Based on the adjacent, steeply sloped grades, a number of new retaining walls will be required. The design options have been reviewed from a structural standpoint to determine the locations where retaining walls will be required, as well as their approximate heights and lengths. One option includes the addition of a single-span bridge. In all options, an existing foundation located east of the existing parking area will be removed. Additionally, some of the rock walls adjacent to the existing parking area will require removal.

In order to determine the locations where the retaining walls are required, the following assumptions have been made:

- Grades along parking access roads (both from the main road and between parking areas) are limited to 8%.
- Grades for new roadways not leading directly into the parking area(s) have been limited to 15%.
- Grades across parking areas vary, with a maximum of 3%.
- Re-grading (both cut and fill) is the first option. Retaining walls are added only where re-grading is not possible.

Square footage costs are taken from the WSDOT Bridge Design Manual (BDM), Chapter 12, Construction Costs, updated October 2004. Due to the preliminary nature of the Design Options, costs from the higher end of the range are used, as recommended in the BDM. For estimating purposes, two types of retaining walls were considered: walls under 6-feet in height will utilize a rock wall (similar to existing walls); walls above 6-feet in height will utilize a cast-in-place cantilever retaining wall.

Although re-grading costs are not included in the estimate for this section, the locations where the soils will be re-graded (rather than use of retaining walls) are identified. The removal, addition, or relocation of existing stairway systems is not included in the structural review or accompanying cost estimate, nor is the removal of the existing parking lot asphalt in respective options. A summary of the structural systems anticipated for each design option is provided below.

DESIGN OPTION 1 – Supplemental Upper Parking Lot

This option provides 70 new parking spaces in a lot located directly above the existing 35-space parking lot. A new parking access road leads to the upper parking lot with a connection loop between the two lots at their north ends.



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A retaining wall is required along the east (up-hill) side of the upper parking lot. This wall begins at the access road and continues around the north loop between the lots. This retaining wall will be approximately 700-feet in length, with an average height of 19-feet and a maximum height of 27-feet.

Re-grading will be performed between the two lots, except at the northeast corner of the existing lot, where the two parking areas are in closest proximity. At this location a 5-foot high, 30-foot long rock wall is required.

A small, 50-foot long portion of an existing rock wall will require removal in this option.

DESIGN OPTION 2 – Two New Uphill Parking Areas with New Roadway

This option consists of the removal of the existing parking area and construction of two new parking lots uphill, to the east. The lower of these two lots contains 27 parking spaces; the upper contains 48 stalls. Both are accessed by a new parking access road just south of the existing parking access road, and they are connected through a loop at the northern end, similar to Option 1. A new roadway and turn loop are located on the west side of the existing parking area and access road.

A retaining wall is required along the east-most (up-hill) side of the upper parking lot. This wall begins at the access road and continues around the north loop between the lots. This retaining wall will be approximately 715-feet in length, with an average height of 24-feet and a maximum of 42-feet.

Re-grading will be performed between the two new lots and the new roadway at the existing parking area. A 5-foot high rock wall is required on the west side of the new roadway in the vicinity of the northwest corner of the existing parking lot.

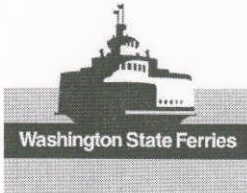
Approximately 735-feet of existing retaining walls require removal: the wall along the west side of the existing lot; the wall on the east of the existing parking access road, and the wall at the southeast corner of the existing lot.

DESIGN OPTION 3 – Supplemental Upper Parking Lot with New Roadway

Revisions to the parking areas are identical to Option 1, above. A new 70-space parking area will be added uphill of the existing parking lot, with a new parking access road and connection loop at the north. The difference between these options is the addition of a new roadway to the east of the upper parking area. Re-grading can be performed between the upper parking lot and the new roadway; therefore, although the parking area layouts are the same as for Option 1, the wall heights are revised.

A new 6-foot high rock wall is located along the first 125-feet of the east side of the parking access road. At the southeast corner of the parking lot, this wall changes to a 560-foot long cantilever retaining wall along the east side of the upper lot, with an average height of 23-feet. The new roadway requires a 175-foot long wall of 15-foot average height on its east side, running easterly from the point where the new road and upper parking area are in closest proximity.

A small, 50-foot long portion of an existing rock wall will require removal in this option.



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DESIGN OPTION 4 – New Upper Parking Area, Holding Area and Bridge Link

A new 50-stall parking lot is located uphill of the existing lot. Access to this new lot is from a side road. The existing parking area will be enlarged to accommodate a 110-car holding area, and a bridge will be added at the northernmost end of the holding area to cross over onto the ferry trestle.

Re-grading will eliminate the need for retaining walls on the east side of the new parking area, the east parking access road, and the east side of the west access road. Retaining walls are required beginning approximately 100-feet into the west access road. This wall runs along the west side of the parking area, with a return on the north side. The length of this wall is approximately 500-feet long, with an average height of 32-feet.

To allow passenger access to the holding area, small retaining walls are located perpendicularly between the holding area and the parking area, approximately 150-feet apart. These return walls are 30-feet and 50-feet in length (north and south walls, respectively) and have an average height of 26-feet.

The holding area has retaining walls on the east side of the holding access road (up to the south return wall to the upper lot), along the east side of the area (beginning at the north return wall to the upper lot), and on the west side of the holding area just before the bridge. These walls have combined lengths of 550-feet and an average height of 18-feet.

The bridge located between the holding area and the ferry trestle is approximately 85-feet long and 28 feet wide, with two 10-foot lanes, one 6-foot shoulder, and one 2-foot shoulder. For preliminary estimation purposes this bridge is assumed to be a precast-prestressed girder structure.

For this option, all rock walls on the east side of the existing parking area and parking access roads (approximately 730-feet in length) will require removal. The rock wall on the west side of the existing lot is to remain.